REPORT UPON GROUND WATER CONDITIONS OF THE SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

MARCH 10, 1964

J. Robert Roll

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REPORT
UPON GROUND WATER
CONDITIONS
OF THE
SANTA CLARA VALLEY WATER CONSERVATION DISTRICT

March 10, 1964

J. Robert Roll
Chief Engineer

Honorable Board of Directors
Santa Clara Valley Water Conservation District
15420 Almaden Road
San Jose 18, California

Gentlemen:

In accordance with Section 19.10 of the Water Conservation Act of 1931 and your Resolution No. 683, presented herewith is a Report Upon Ground Water Conditions Of The District.

Respectfully submitted,

J Robert Roll

J. Robert Roll
Chief Engineer
Santa Clara Valley Water Conservation District

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Enclosure

INTRODUCTION

For the purpose of this report the District is divided into two Zones. One covers the original District together with all of the inclusions northwesterly of Metcalf Road. The second one covers the former Central Santa Clara Valley Water Conservation District together with all the inclusions southeasterly of Metcalf Road.

This division is made as a result of Resolution No. 681 of the Board of Directors of the Santa Clara Valley Water Conservation District which indicated its intent to divide the District into two zones if and when a ground water extraction charge is imposed by said Board.

In order for the Board of Directors to make the determinations that are required of them by Section 19.11 of the Water Conservation Act of 1931, certain engineering data and recommendations must be made available to them by this report.

INFORMATION AVAILABLE

Since the completion of the original facilities in 1934-1936, the District has maintained detailed records of rainfall, streamflow, percolation, ground water levels, reservoir storage and releases, and evaporation. In addition, it has made estimates of pumping draft based upon available information.

RAINFALL

In addition to the official Weather Bureau records which are available in Santa Clara Valley, the District maintains 16 rain gages. It also receives rainfall records from 12 private individuals who maintain rain gages for the District.

The station with the longest period of record in the Valley is the official Weather Bureau station at San Jose. This record extends back to 1874. The long-time average rainfall at this station is 14.0 inches. The record from this station for the period 1909 to 1963 is plotted graphically at the bottom of Plate I.

It will be noted that the rainfall for the past season, that is the 1962-1963 season, was over twenty inches which made it one of the wettest years on record. In addition to being a wet year, it was also a year of late rainfall. These two factors combined to reduce the pumping draft materially by eliminating the Spring irrigation almost entirely.

STREAMFLOW AND PERCOLATION

While the original District facilities were being constructed in 1934-36, a program of streamflow measurements was started. This has been expanded over the years until now the District maintains and operates 50 streamflow stations. In addition to these stations, the United States Geological Survey supplies the District with records from 10 stations.

The purpose of these stations is to measure the total inflow to the valley and the total outflow to San Francisco Bay. The difference between these two quantities is the amount of water salvaged from the runoff. Table I gives the total annual amount of water salvaged and the amount salvaged by District operations. The values presented for the last two seasons are estimates based upon incompleted analyses of streamflow records.

It is interesting to note that the operation of the District's facilities over the past 28 years has been responsible for salvaging over one million acre-feet of water that would otherwise have wasted into San Francisco Bay.

GROUND WATER LEVELS

Prior to 1930, a limited number of ground water level measurements were made in Santa Clara Valley. Around the turn of the century, the Bay Cities Water Company carried on extensive investigations of the water supply in Santa Clara Valley. From 1914-1920 the United States Geological Survey conducted an investigation in this area. From 1920-1923 Tibbetts & Kieffer were retained by the local farmers to make a detailed investigation of water conditions in the Valley. From 1929-1932 the State of California conducted an investigation of water conditions in the Valley on a cooperative basis with local governmental agencies.

In 1932 this District took over the data collecting functions that had previously been carried on by a variety of agencies. Subsequent ground water level records were obtained from the same set of observation wells that had been used by the State. Many of those had records extending back through the previous studies.

This program has been expanded so that at the present time the District is measuring depth to water in 300 wells uniformly distributed over the Valley. From these measurements the average depth to water in the entire Valley is obtained. The changes that occur in various geographical areas of the Valley are also computed.

Plate I shows the average depth to water at the end of the irrigation season each year since 1909. The end of the irrigation season is the low point of the annual fluctuation and is the most critical period of each season.

Plate II shows the fluctuation in depth to water in each of the geographical areas into which the Valley is divided, for the last five years.

It will be noted from Plates I & II that the average depth to water in the Valley rose 15.2 feet during 1963. Although the average was up 15.2 feet, the rise was not uniform throughout the Valley.

In the Almaden-Calero area there was a 1.3 foot drop during this period. The average depth to water in this area, however, is only about 10 to 15 feet. In the Berryessa area the rise was 7.5 feet; in the Evergreen-Mt. Pleasant area it was 7.4 feet; and in the Morgan Hill area it was up 37.5 feet.

Along with its program of measuring depths to water, the District also samples water from 40 wells in various locations for water quality analysis. The major area of concern is the land along the Bay front where the danger of salt water intrusion is ever-present.

RESERVOIR STORAGE AND RELEASES

In order to differentiate between waters naturally percolated and those that have been salvaged by District reservoirs and percolation facilities, it is necessary to maintain accurate records of reservoir storage and storage releases.

These records, in conjunction with the streamflow records, enable the District to accurately determine the amount of both stored water and natural flow that percolates in various locations.

The eight District reservoirs have a combined capacity of 156,900 acre-feet. Even though last season, 1962-1963, was very wet the maximum storage was only 95,090 acre-feet.

One of the necessary components in determining reservoir storage releases is evaporation. In order to measure this factor, the District maintains three evaporation stations. The annual evaporation as indicated by those stations in 1962-63 was 37.9 inches, which is about ten percent below normal.

PUMPING DRAFT

It has been extremely difficult to obtain accurate records of pumping draft because all wells are not metered. The municipal water use can be accurately determined as this is all metered. The agricultural use, however, must be estimated. One convenient method of doing this is by computing the agricultural pumping draft from the records of agricultural power sales and the depth to water records maintained by the District. This method was used by H. L. Haehl, Chief Engineer of the Bay Cities Water Co. to determine pumping draft for the period 1913 to 1934. It has also been used by the State of California during their studies in Santa Clara Valley.

The District has continued this computation since 1934. The results of these calculations are listed in Table II. These records are obviously subject to considerable error inasmuch as they are based upon a series of assumptions. They do, however, indicate the range over which agricultural pumping draft varies.

SUBSIDENCE

As the average water level declined during the period from 1916 to 1936, the ground surface in the central portion of the Valley dropped. This subsidence of the ground surface was caused by a consolidation of clays in the underlying alluvium as a result of a lowering of the water table. This consolidation squeezed water from these clays.

As the water level rose during the period from 1936 to 1943, the subsidence stopped and then commenced again when the water level dropped after 1943. The rise in water level that occurred between 1950 and 1963 was not great enough to stop subsidence.

In recent years, the amount of water that has been drained from the confining clay strata by this process has averaged about 14,000 acre-feet per year. This water has been pumped out by wells and has added to the available supply. It is, however, an undesirable source of water in that the process is causing great damage to existing drainage facilities.

OVERDRAFT

Even though the average water level in the valley rose during the past year, there was still an overdraft on the ground water supply because of two undesirable withdrawals. One is the water of compaction which results in land subsidence. The other is an indeterminable amount of water that possibly is being withdrawn from aquifers beneath San Francisco Bay.

According to Section 19.7 of the Water Conservation Act of 1931, Annual Overdraft is defined as the amount by which the production of water from ground water supplies within the District or any zone or zones thereof during the water year exceeds the natural replenishment of such ground water supplies in such water year. Under this definition, neither water of compaction nor withdrawal from aquifers from beneath the Bay constitute an overdraft because they are natural occurrences.

However, because of the desirability of stopping subsidence and of eliminating any withdrawals, if any, from beneath the Bay these two sources of water will be considered as overdraft.

DATA REQUIRED BY ACT

Section 19.11 of the Water Conservation Act of 1931 requires the Board of Directors to make certain determinations prior to levying a ground water charge.

The data necessary in order to make the required determinations for the zone North of Metcalf Road is presented in Table III. The corresponding data for the zone South of Metcalf Road is presented in Table IV.

In Table III, items 1, 3 and 4 need explanation. The average annual overdraft is given in item 1 as 21,200+ acre-feet per year. Of this amount 7,200 acre-feet per year is an actual overdraft resulting in a lowering of the water table. The balance of 14,000+ acre-feet per year is water of compaction plus withdrawal from beneath the Bay, if any. As was explained earlier, these items are strictly not overdraft as they cannot be replaced but are indicated as such because it is desirable to stop these two withdrawals. The same explanation applies to items 3 and 4.

The amount shown in item 9 in Table III is the minimum amount of water that must be added to the underground basin to supply the total pumping draft for the ensuing water year. This does not provide any water for alleviating the accumulated overdraft.

RECOMMENDATIONS

In conformity with Resolution No. 681 of the Board of Directors of the Santa Clara Valley Water Conservation District, it is recommended that the Board establish a zone within which to levy a ground water extraction charge.

This zone should encompass all of the District except the following Santa Clara County Tax Code Areas:

Tax Code Area

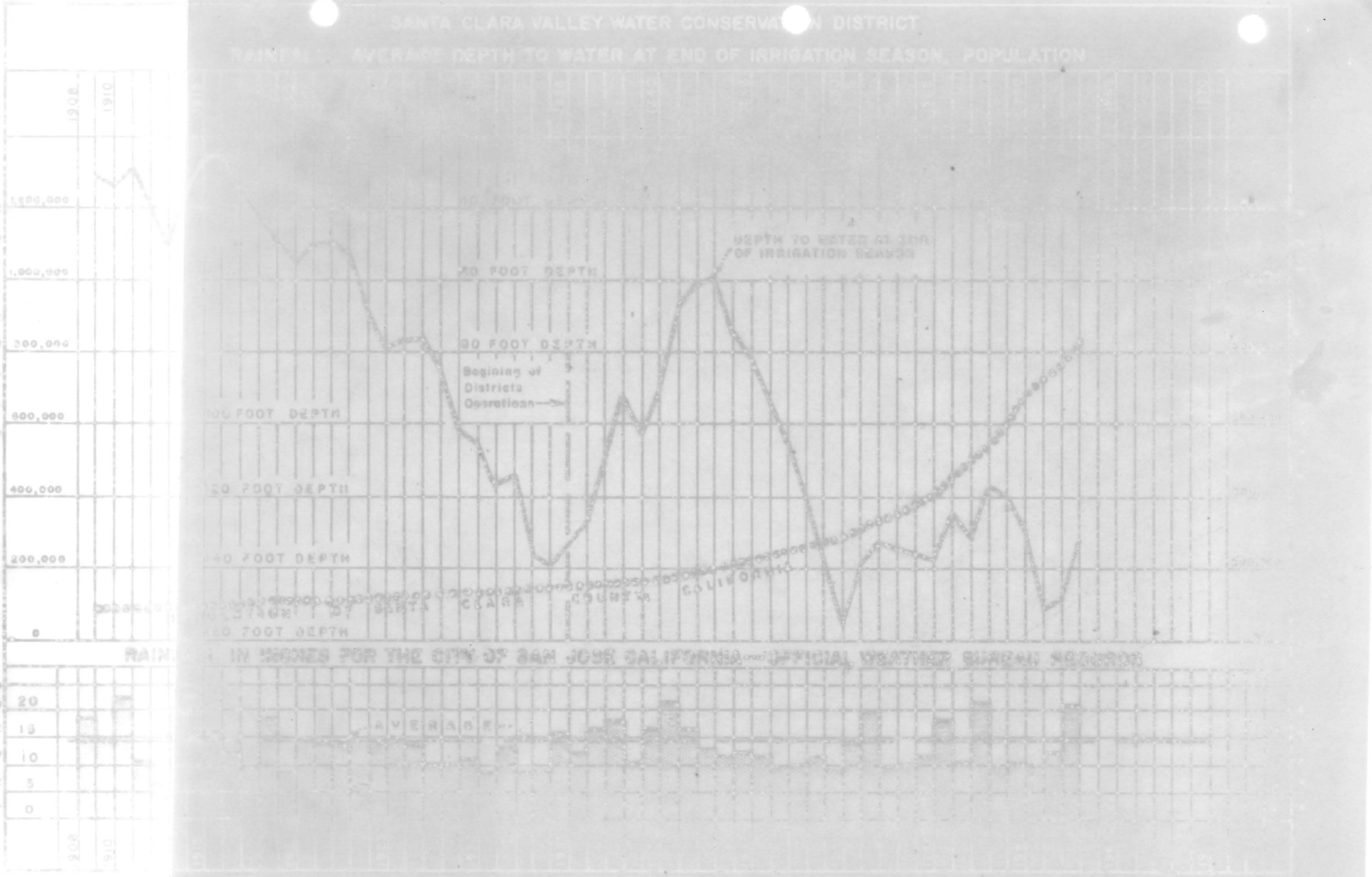
4-000
4-001
4-003
4-006
4-008
40-459
40-464
40-575
40-644

64-004
64-012
87-001
87-014
87-018
87-020
87-021
87-028
99-005

In general this is all of the land within that portion of the District lying northwesterly of Metcalf Road.

It is further recommended that the Board of Directors levy a pump tax in this zone based upon an estimated pumping draft of 80,000 acre-feet of agricultural water, 140,000 acre-feet of municipal and industrial water and a surface delivery for agricultural purposes of 6,000 acre-feet.

PLATE 1


SANTA CLARA VALLEY WATER CONSERVA[illegible]N DISTRICT
RAINFA[illegible] – AVERAGE DEPTH TO WATER AT END OF IRRIGATION SEASON, POPULATION
1908
1910
POPULATION
1,200,000
1,000,000
800,000
600,000
400,000
200,000
0
60 FOOT DEPTH
80 FOOT DEPTH
90 FOOT DEPTH
100 FOOT DEPTH
120 FOOT DEPTH
140 FOOT DEPTH
160 FOOT DEPTH
DEPTH TO WATER AT END OF IRRIGATION SEASON
Begining of Districts Operations
POPULATION OF SANTA CLARA COUNTY, CALIFORNIA
RAINFALL IN INCHES FOR THE CITY OF SAN JOSE CALIFORNIA — OFFICIAL WEATHER BUREAU RECORDS
INCHES
20
15
10
5
0
AVERAGE

SANTA CLARA VALLEY WATER CONSERVATION DISTRICT
FLUCTUATION OF AVERAGE WATER LEVEL

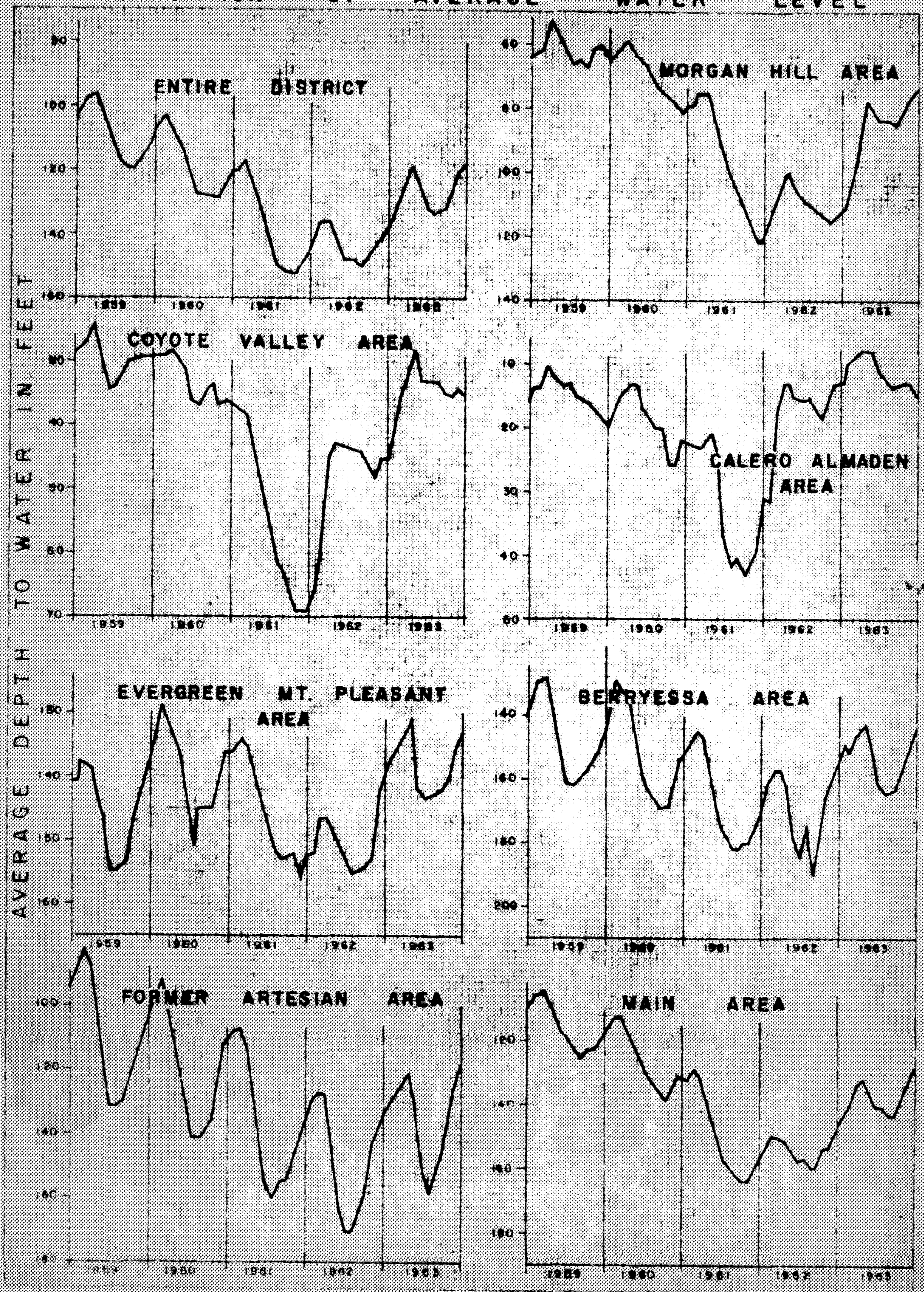


PLATE 2

TABLE I

WATER SALVAGED IN ACRE-FEET

YEAR	NATURAL	By S.C.V.W.C.D.	TOTAL
1939-40	57,090	39,990	97,080
1940-41	107,020	38,260	145,280
1941-42	70,460	36,340	106,800
1942-43	52,930	38,270	91,200
1943-44	33,680	38,670	72,350
1944-45	37,670	39,710	77,380
1945-46	41,180	41,000	82,180
1946-47	22,730	6,200	28,930
1947-48	21,260	6,340	27,600
1948-49	37,230	22,170	59,400
1949-50	22,290	13,440	35,730
1950-51	59,360	57,380	116,740
1951-52	92,570	49,630	142,200
1952-53	41,540	55,080	96,620
1953-54	29,740	52,580	82,320
1954-55	26,560	44,960	71,520
1955-56	63,230	65,110	128,340
1956-57	26,060	63,090	89,150
1957-58	68,490	61,770	130,260
1958-59	21,260	87,450	108,710
1959-60	15,060	72,410	87,470
1960-61	9,750	23,220	32,970
1961-62	* 40,000	* 75,000	115,000
1962-63	* 70,000	* 80,000	150,000
TOTALS	1,067,160	1,108,070	2,175,230

* Estimates - subject to revision

TABLE II

COMPUTED AGRICULTURAL PUMPING DRAFT

YEAR	NORTH S.C. VALLEY	COYOTE VALLEY	TOTAL
1934-35	55,000	4,100	59,100
1935-36	68,000	5,100	73,100
1936-37	64,000	4,800	68,800
1937-38	60,900	4,500	65,400
1938-39	80,700	6,000	86,700
1939-40	81,500	6,100	87,600
1940-41	79,400	5,900	85,300
1941-42	83,400	6,200	89,600
1942-43	98,600	7,300	105,900
1943-44	111,700	8,300	120,000
1944-45	100,300	7,500	107,800
1945-46	100,900	7,500	108,400
1946-47	110,300	8,200	118,500
1947-48	107,300	8,000	115,300
1948-49	96,300	7,200	103,500
1949-50	93,300	6,900	100,200
1950-51	86,500	6,400	92,900
1951-52	81,900	6,100	88,000
1952-53	94,800	7,000	101,800
1953-54	99,100	7,400	107,500
1954-55	100,300	7,500	107,800
1955-56	91,900	6,800	98,700
1956-57	93,300	6,900	100,200
1957-58	78,300	5,800	84,100
1958-59	99,400	7,400	106,800
1959-60	87,900	6,500	94,400
1960-61	80,700	6,000	86,700
1961-62	61,700	4,600	66,300
1962-63	56,000	4,100	60,100

TABLE III

1.	Average annual overdraft for the immediate past 10 water years.	21,200+ a.f./yr.
2.	Accumulated overdraft as of the last day of the preceding water year	492,000 ac. ft.
3.	Estimated annual overdraft for the current water year.	32,000+ a.f.
4.	Estimated annual overdraft for the ensuing water year	14,000+ a.f.
5.	Estimated accumulated overdraft as of the last day of the current water year	510,000 a.f.
6.	Estimated amount of agricultural water to be withdrawn from the ground water supplies of the District for the ensuing water year	80,000 a.f.
7.	Estimated amount of water other than agricultural water to be withdrawn from the ground water supplies of the District for the ensuing water year.	140,000 a.f.
8.	Estimated amount of water needed for surface distribution for the ensuing water year.	6,000 a.f.
9.	Amount of water that is necessary for the replenishment of the ground water supplies of the District for the ensuing water year	* 220,000 a.f.
10.	Amount of water the District is obligated to purchase during the ensuing water year.	None
11.	Estimated total production of water from the ground water supplies of the District for the preceding water year.	210,000 a.f.

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* This is the minimum amount needed to provide for the estimated pumping draft during the ensuing water year.

TABLE IV

1. Average annual overdraft for the immediate past 10 water years.	- 1,300 a.f./yr.
2. Accumulated overdraft as of the last day of the preceding water year	None
3. Estimated annual overdraft for the current water year	None
4. Estimated annual overdraft for the ensuing water year	None
5. Estimated accumulated overdraft as of the last day of the current water year	None
6. Estimated amount of agricultural water to be withdrawn from the ground water supplies of the District for the ensuing water year	16,000 a.f.
7. Estimated amount of water other than agricultural water to be withdrawn from the ground water supplies of the District for the ensuing water year.	1,400 a.f.
8. Estimated amount of water needed for surface distribution for the ensuing water year	2,000 a.f.
9. Amount of water that is necessary for the replenishment of the ground water supplies of the District for the ensuing water year.	* 17,400 a.f.
10. Amount of water the District is obligated to purchase during the ensuing water year.	None
11. Estimated total production of water from the ground water supplies of the District for the preceding water year.	16,000 a.f.

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* This is the minimum amount needed to provide for the estimated pumping draft during the ensuing water year.